ORIGINAL ARTICLE

Prevalence of Osteoporotic Changes in Panoramic Radiographs of Patients showing Carotid Calcifications

Tarunjeet Pabla, Aruna Ramesh

ABSTRACT

Objectives: *Atherosclerosis and Osteoporosis are two of the most prevalent chronic diseases in the western world. They share common risk factors and many studies suggest an association between arterial calcification and low bone mass possibly due to common etiology.(1-3) The aim of this pilot study is to study the prevalence of osteoporotic changes in patients showing evidence of carotid plaques on panoramic radiographs.*

Methods: *Of the panoramic radiographs done on dental school patients from 2004-2005, 24 radiographs showing frank evidence of carotid plaque were selected and reviewed for osteoporotic changes using the criteria by White et al.(4)*
Results: 95% of our study patients showed evidence of osteoporotic changes in their mandibular cortex.

Conclusions: *Given the results of our pilot study, it is important that dentists should screen for osteoporosis in patients showing carotid atherosclerosis.*

Keywords: *Atherosclerosis, Osteoporosis, panoramic radiography, calcified carotid atheromatous plaque, mandibular cortical shape.*

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Panoramic radiographs have shown to be useful in providing information related to generalized disease processes due to a wider coverage of the maxillofacial complex on the image. The usefulness of panoramic imaging for detection of both osteoporotic changes in the mandible and calcified carotid atherosclerotic plaque independently has been documented.(4-9) Skeletal changes have been reported in patients with cardiovascular disease, suggesting a relationship between osteoporosis and atherosclerosis.(1-3,10,11)

The objective of this pilot project was to study the prevalence of osteoporotic changes in patients showing evidence of calcified carotid plaques on panoramic radiographs.

Methods

Panoramic images obtained on patients at Tufts University School of Dental Medicine (TUSDM), Boston, Massachusetts, USA, were reviewed. The first 24 radiographs with frank evidence of calcified carotid atheromatous plaque were selected for the study. This selection was based on the consensus reached by two oral and maxillofacial radiologists (board certified by American Board of Oral and Maxillofacial Radiology). Calcified atheromatous plaque in the carotid was identified as an area of calcification inferior and posterior to the angle of the mandible. This area corresponds to the region of carotid artery bifurcation in the neck at the level of 3rd and 4th cervical vertebrae. The study population comprised of 18 males and 6 females ranging in age from 43 to 90 years. Fig.1 shows panoramic radiograph with evidence of bilateral calcified carotid atheromatous plaque.

Panoramic Measurements

Mandibular Cortical Shape

Mandibular cortical shape was evaluated using Klemetti *et al* classification.(8) The inferior cortex was detected on both sides

Fig.1: Panoramic radiograph showing evidence of bilateral calcified carotid atheromatous plaque

of the mandible, distally from the mental foramen. Subjects were classified into three groups (C1-C3) by two OMF radiologists. Fig. 2 shows a diagramatic representation of the classification criteria of the mandibular cortex where, C1: the endosteal margin of the cortex was even and sharp on both sides; normal cortex, C2: the endosteal margin showed semilunar defects (lacunar resoprtion) or seemed to form endosteal cortical residues; mildly to moderately eroded cortex, C3: the cortical layer formed heavy endosteal cortical residues and was clearly porous; severely eroded cortex.

Mandibular cortical width

Measurement of mandibular cortical width was made bilaterally following the method of White *et al*.(4) A line tangential to the inferior border of the mandible was drawn in the region of mental foramen. A line perpendicular to this tangent intersecting inferior border of mental foramen was constructed, along which mandibular cortical width was measured using calipers. Mean cortical width on both sides of the jaw was used in the study. Final width was obtained by calculating the mean of both the observers' values. A 30% correction was made to the final measurement to account for

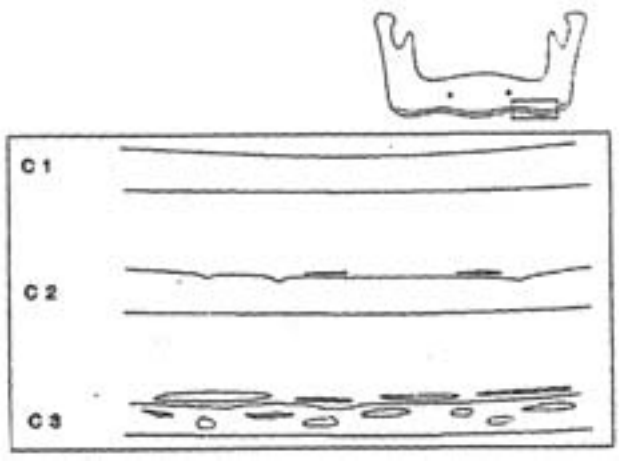

Fig. 2: Classification of mandibular cortex (C1-3) based on changes in inferior cortex on panoramic x-ray images

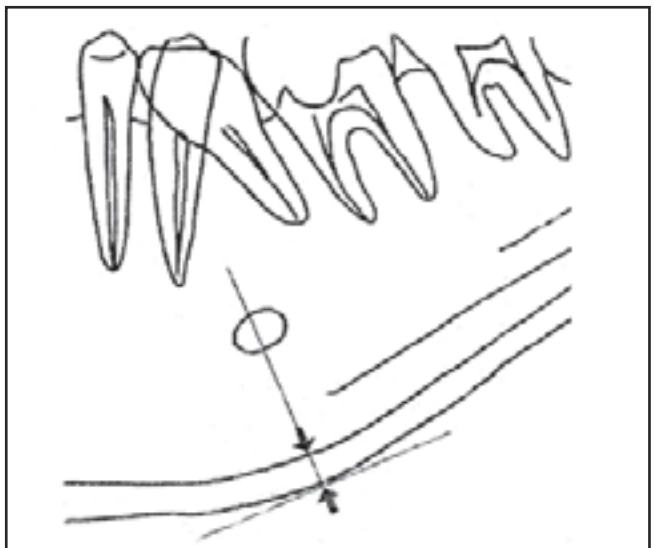

Fig. 3: Diagram of cropped panoramic radiograph. Arrows indicate Mandibular cortical width

magnification factor. Fig. 3 provides a diagramatic representation of the above method. IRB approval was obtained for the study.

RESULTS

More than 95% of our study patients showed evidence of osteoporotic changes in their mandibular cortex with 70% showing severe osteoporotic changes. 83% (n=20) of our patients showed a mandibular cortical width less than 4 mm and were grouped into the osteopenic/osteoporotic group. Fig. 4 shows the percentage distribution of patients in each category of mandibular cortical shape : C1- C3. Fig. 5 shows the distribution of patients according to mandibular cortical thickness.

DISCUSSION

A strong correlation has been found between mandibular cortical width measured at the mental region and mandibular cortical density (MCD) values obtained from Quantitative Computed Tomography (QCT).(9)

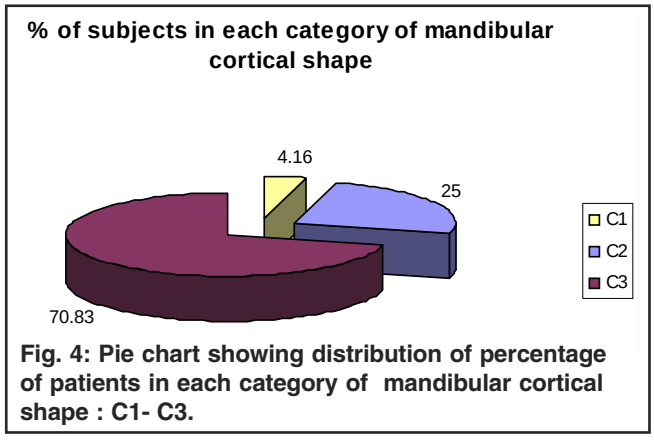

Fig. 4: Pie chart showing distribution of percentage of patients in each category of mandibular cortical shape : C1- C3.

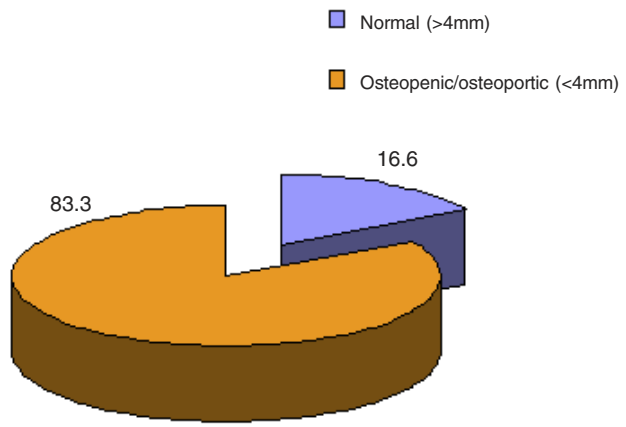

Fig. 5: Pie chart showing distribution of patients according to mandibular cortical thickness

In regions distal to mental foramen, the buccal cortex has been reported to correlate better with skeletal mineral density values than the lingual portions. On panoramic images the inferior cortex is a reflection of an area that represents neither of these. On such images however the inferior cortex of the mandible is the most suitable bony structure for study because it is clearly visible, and the buccal cortex reflects the mineral status of the skeleton.(8) Also the use of vertical measurements in panoramic radiography has been employed in many studies as the vertical measurements are less influenced by patient positioning and show rather stable values in the premolar-molar areas.(9)

A width of 4 mm was chosen as cut off to classify a patient into normal or osteopenic / osteoporotic groups. Klemetti *et al* found that the diagnostic threshold of 4 mm width of inferior border is optimal.(8) According to White *et al*, if dental panoramic radiographs are used in assessing patients for signs of osteoporosis, it is more appropriate to set the threshold in the mid 4mm range to identify substantively more individuals with low bone mass.(4) If this were applied to our sample, 87.5% of our patients will be under the osteopenic/osteoporotic group. However this method of classifying patients is very technique sensitive and does not allow the dentist to perform chair-side visual diagnosis.

Klemetti *et al* reported a significant correlation between their classification (C1-C3) and vertebral BMD using DXA.(8) The significance of this study is that more than 2/3rds of the study population showed evidence of osteoporotic changes along with presence of carotid plaque. While most of the osteoporosis research is done on post-menopausal women, our study comprised of 75% men. We do realize that the sample size is small and the aim of this pilot was to screen for prevalence of finding osteoporotic changes on panoramic radiographs of patients showing calcified carotid plaque. This pilot study paves way for a future case-controlled study with a larger sample size in order to find a definitive correlation on panoramic radiographs.

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